

CR-91 Event – Shelby County, AL
Preliminary Air Monitoring Summary
September 21, 2016 05:00

Prepared by
Center for Toxicology and Environmental Health, L.L.C. (CTEH®)
On Behalf of Colonial Pipeline



Introduction

On September 9, 2016, the Center for Toxicology and Environmental Health, L.L.C. (CTEH®) initiated air monitoring in support of response efforts to the gasoline release in Shelby County, AL. This report presents the real-time air monitoring data recorded from September 20 2016 05:00 to September 21, 2016 05:00 CDT.

Real-Time Air Monitoring¹

Real-time air monitoring was conducted to evaluate the potential airborne presence of gasoline-associated constituents, if any, during response operations. All instrumentation was calibrated at least once per day or per manufacturer's recommendations. Target analytes were measured as total volatile organic compounds (VOCs), oxygen, benzene, gasoline, hexane, naphthalene, xylene, and flammability as the percent of the lower explosive limit (LEL) using remote telemetering RAESystems® AreaRAEs, hand-held instruments such as RAESystems® MultiRAE Pro/Plus¹ and UltraRAEs, as well as Gastec® colorimetric detection tubes.

During this monitoring period, four benzene, two LEL, and 22 VOC detections were recorded above the action level concentration during worker activity monitoring. During those instances when detections were sustained, workers were either wearing respiratory protection, or egressed the area in accordance with the approved sampling and analysis plan.

Table 1, below, presents the results of real-time air monitoring using hand-held instruments. Maps of the incident site location and locations of hand-held real-time air monitoring readings are provided in **Appendix I**.

¹ Real-time air monitoring refers to the use of hand-held instruments that provide near-instantaneous readings of an airborne chemical concentration without the need for laboratory analysis.

*Table 1: Hand-Held Real-Time Air Monitoring Summary¹
September 20, 2016 05:00 to September 21, 2016 05:00*

Location Category	Analyte	Instrument	Count of Readings	Count of Detections	Range of Detections ^{2,3}
Worker Activity Monitoring	Benzene	UltraRAE	181	43	0.05 - 1.6 ppm
	Gasoline	Gastec #101L	9	1	15 ppm
	Hexane	Gastec #102L	8	0	<1 ppm
	%LEL	MultiRAE Plus	74	0	<1 %
		MultiRAE Pro	372	5	2 - 8 %
	Naphthalene	Gastec #60	1	0	<0.1 ppm
	Toluene	Gastec #122	4	0	<1 ppm
		Gastec #122L	5	1	2.5 ppm
	VOC	MultiRAE Plus	75	11	1.2 - 35.2 ppm
		MultiRAE Pro	415	220	0.1 - 500 ppm
Site Characterization	Xylene	Gastec #123	9	2	2.5 - 2.5 ppm
	Benzene	UltraRAE	1	1	70.75 ppm
	%LEL	MultiRAE Pro	2	2	6 – 35 %
	VOCs	MultiRAE Pro	1	1	882.1 ppm

¹Please Note: The data displayed in the above table has not undergone complete QC analysis and is presented in a preliminary format.

²Maximum detections preceded by the "<" symbol are considered non-detections below the instrument limit of detection (LoD) value to the right.

³Numbers are the raw values, no correction factors have been applied.

In addition to worker activity monitoring, remote telemetering equipment established as an early warning system recorded no detections of VOCs above the site-specific action level of 300 ppm and 297 detections of LEL above the action level of 10% (3% as raw values on LEL sensors). **Table 2** (below) summarizes remote telemetering AreaRAE data for this monitoring period, which may contain drift events². **Appendix I** and **Appendix II** include location maps and graphs for remote telemetering data, respectively.

² Drift is defined as any interference in the PID's or electrochemical sensor's ability to accurately report the concentration of a chemical in the atmosphere. Humidity, rapid temperature changes, and compromised batteries are examples of common sources of drift.

Table 2: Remote Telemetry Real-time Air Monitoring Summary^{1,3}
September 19, 2016 05:00 to September 20, 2016 05:00

Unit	Location Description	Analyte	Count of Readings	Count of Detections	Range of Detections ²
AR01	2A Recovery	LEL	4531	10	1.1 - 3.4 %
		O ₂	1836	1836	20.9 - 21.2 %
		VOC	4531	4002	0.1 - 701.2 ppm
AR04	2A Frac Tank Staging	LEL	5179	0	<1 %
		VOC	5179	2410	0.1 - 45.4 ppm
AR05	2A Compressors	LEL	2282	0	<1 %
		VOC	2282	1627	0.1 - 141.4 ppm
AR06	East of Release Site/Near Stopple 2	LEL	5325	0	<1 %
		VOC	5325	3694	0.1 - 189.3 ppm
AR07	2B Recovery	LEL	5094	0	<1 %
		VOC	5094	3946	0.1 - 88.1 ppm
AR08	Main Staging Area Frac Tanks	LEL	5185	0	<1 %
		VOC	5185	2063	0.1 - 13.1 ppm
AR09	Release Site	LEL	3669	0	<1 %
		O ₂	3669	3669	20.4 - 20.9 %
		VOC	3669	2838	0.1 - 402 ppm
AR10	On path between Recovery 2A and Recovery 2B.	LEL	4329	0	<1 %
		VOC	4329	2941	0.1 - 100.5 ppm
AR11	Main Staging Entrance East of TRG checkpoint	LEL	5131	0	<1 %
		VOC	5131	1503	0.1 - 12.7 ppm
AR12	Boom Site #2	LEL	5758	0	<1 %
		VOC	5758	1235	0.1 - 1.8 ppm
AR13	TRG Checkpoint 2 - access to stopple 1, Recovery 2A and 2A Frac Tank Staging Area.	LEL	5116	0	<1 %
		VOC	5116	1547	0.1 - 12.2 ppm
AR14	Cab of excavator at release site	LEL	4801	0	<1 %
		O ₂	844	844	20.9 - 20.9 %
		VOC	4801	2411	0.1 - 31.7 ppm

¹Please note: The data displayed here has not undergone complete QA/QC analysis and is presented in a preliminary format.

²Maximum detections preceded by the "<" symbol are considered at the limit of detection (LoD) value to the right.

³LEL and VOC values are raw values, correction factors have not been applied.

Appendix I:

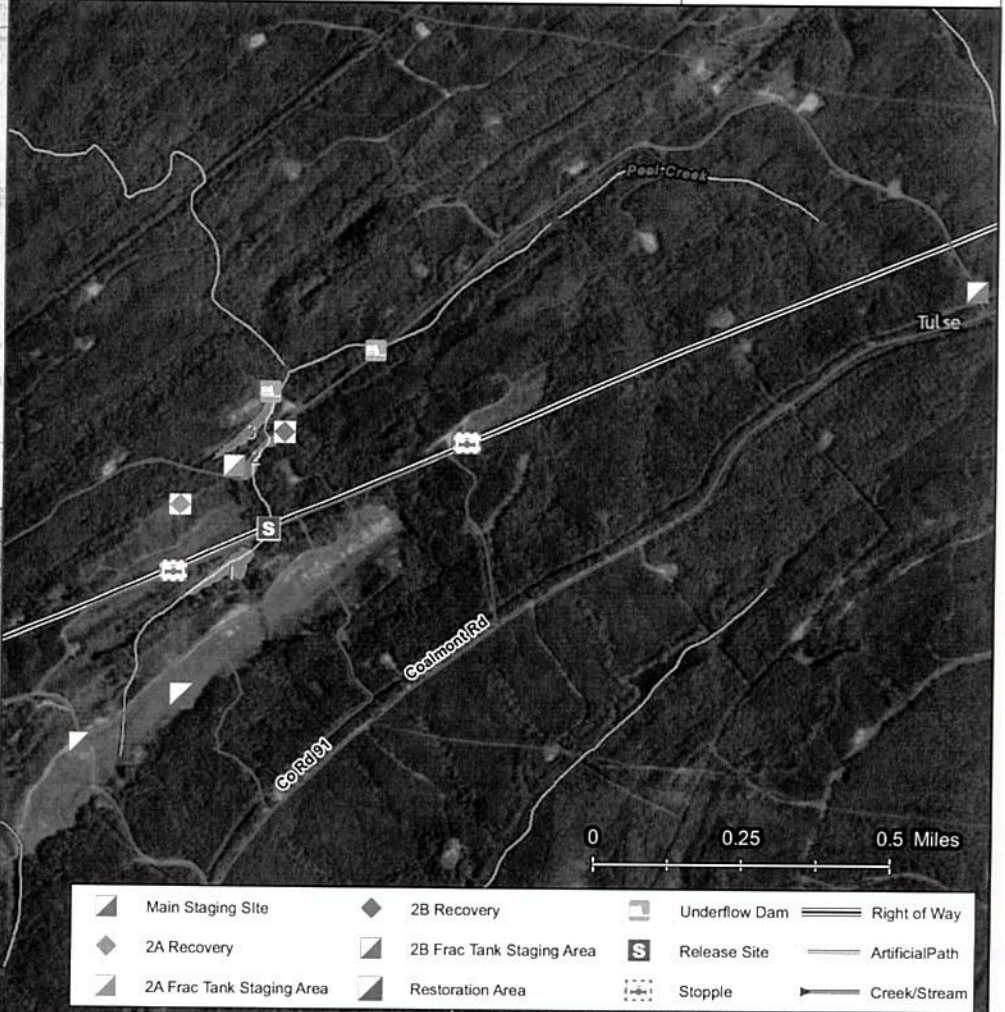
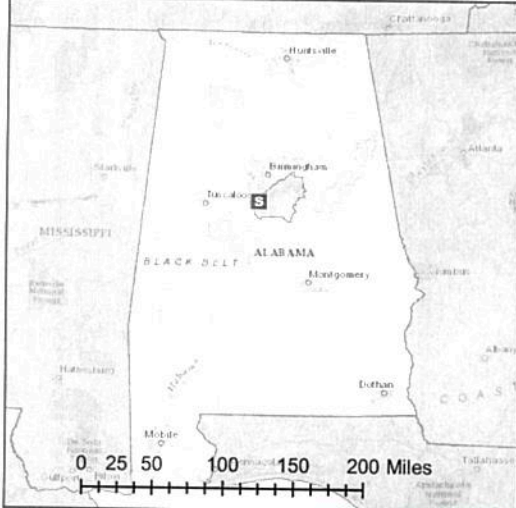
Site Location, Hand-Held Real-Time
Air Monitoring Location, and
Remote Telemetry Air Monitoring
Location Maps

CTEH

CR-91 Event
Site Location



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, AL



PROJECTION SYSTEM: UTM16 COORDINATE SYSTEM: WGS84

Print Date: 9/20/2016

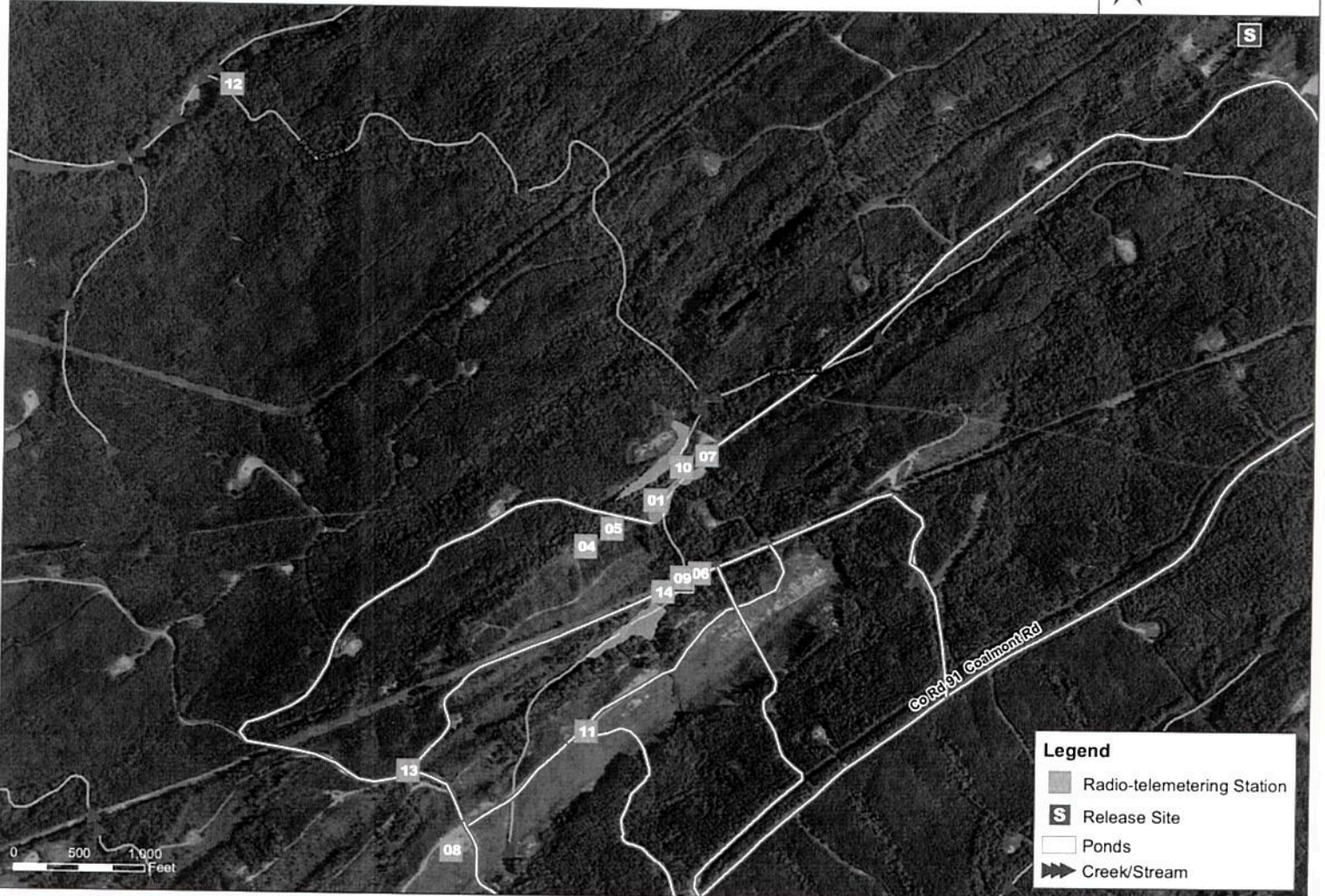


Radio-telemetry Real-time Air Monitoring Station Locations

CR-91 Event 9/21/2016



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, LA



PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

Print Date: 9/21/2016



Manually-Logged Real-Time Reading Locations

CR-91 Event | 09/20/2016 05:00 – 09/21/2016 05:00



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, AL



PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

Print Date: 9/21/2016

*GPS coordinates are approximate

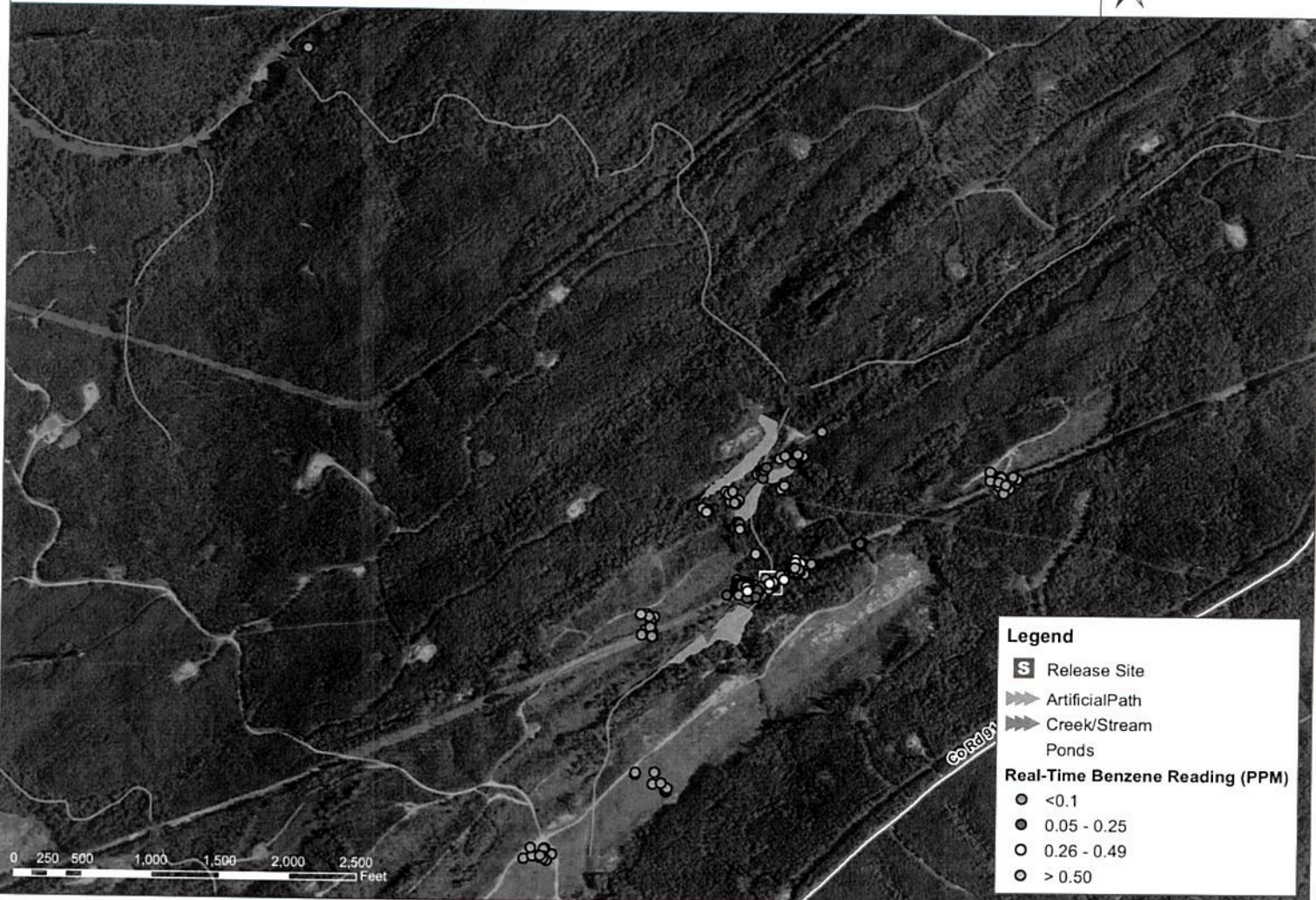


Manually-Logged Real-Time Readings | Benzene

CR-91 Event | 09/20/2016 05:00 – 09/21/2016 05:00



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, AL



PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

*GPS coordinates are approximate

Print Date: 9/21/2016

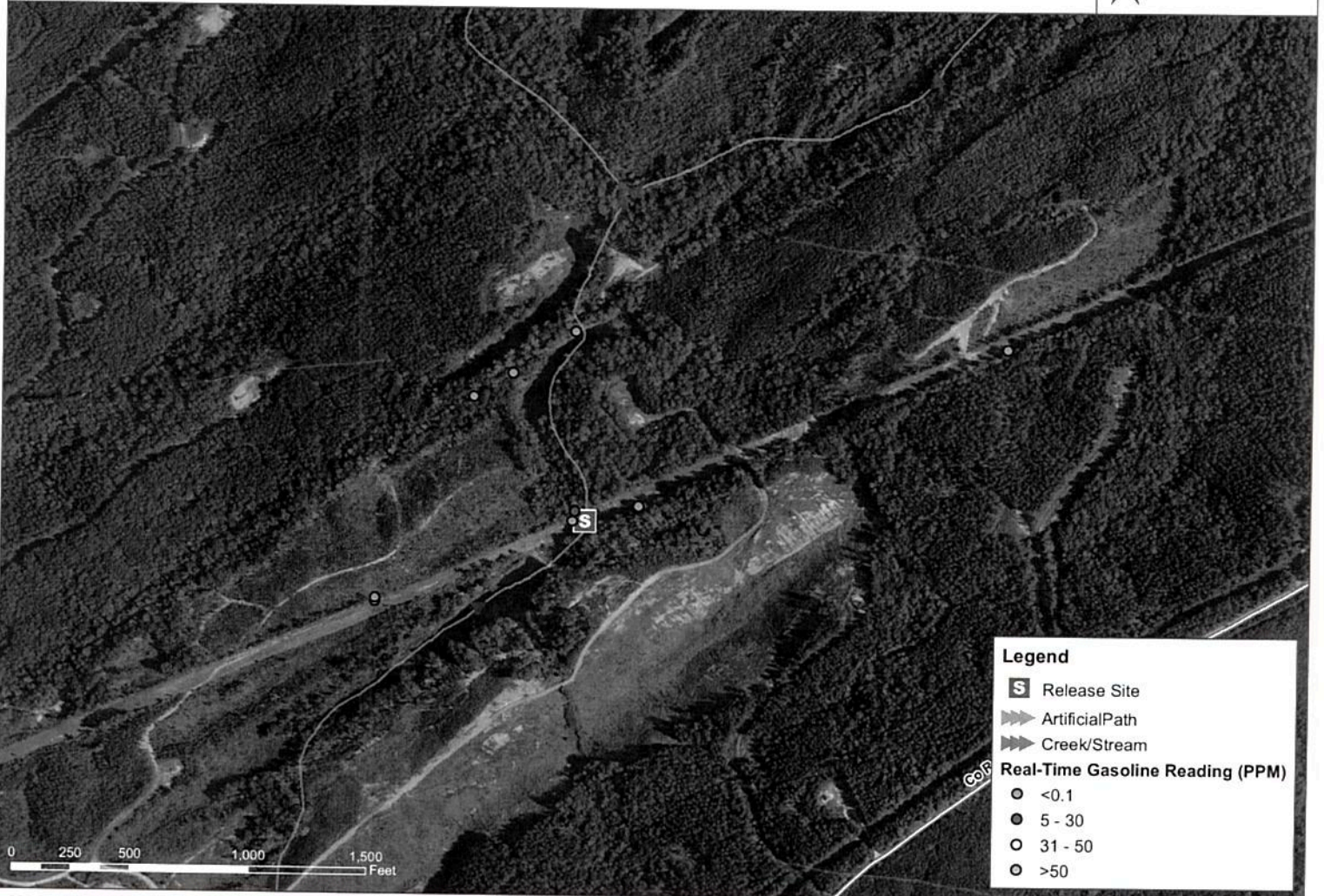


Manually-Logged Real-Time Readings | Gasoline

CR-91 Event | 09/20/2016 05:00 – 09/21/2016 05:00



Project: 108463
Client: Colonial Pipeline
Location: Shelby County, AL



PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

*GPS coordinates are approximate

Print Date: 9/21/2016



Manually-Logged Real-Time Readings | LEL

CR-91 Event | 09/20/2016 05:00 – 09/21/2016 05:00



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, AL



PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

Print Date: 9/21/2016

*GPS coordinates are approximate

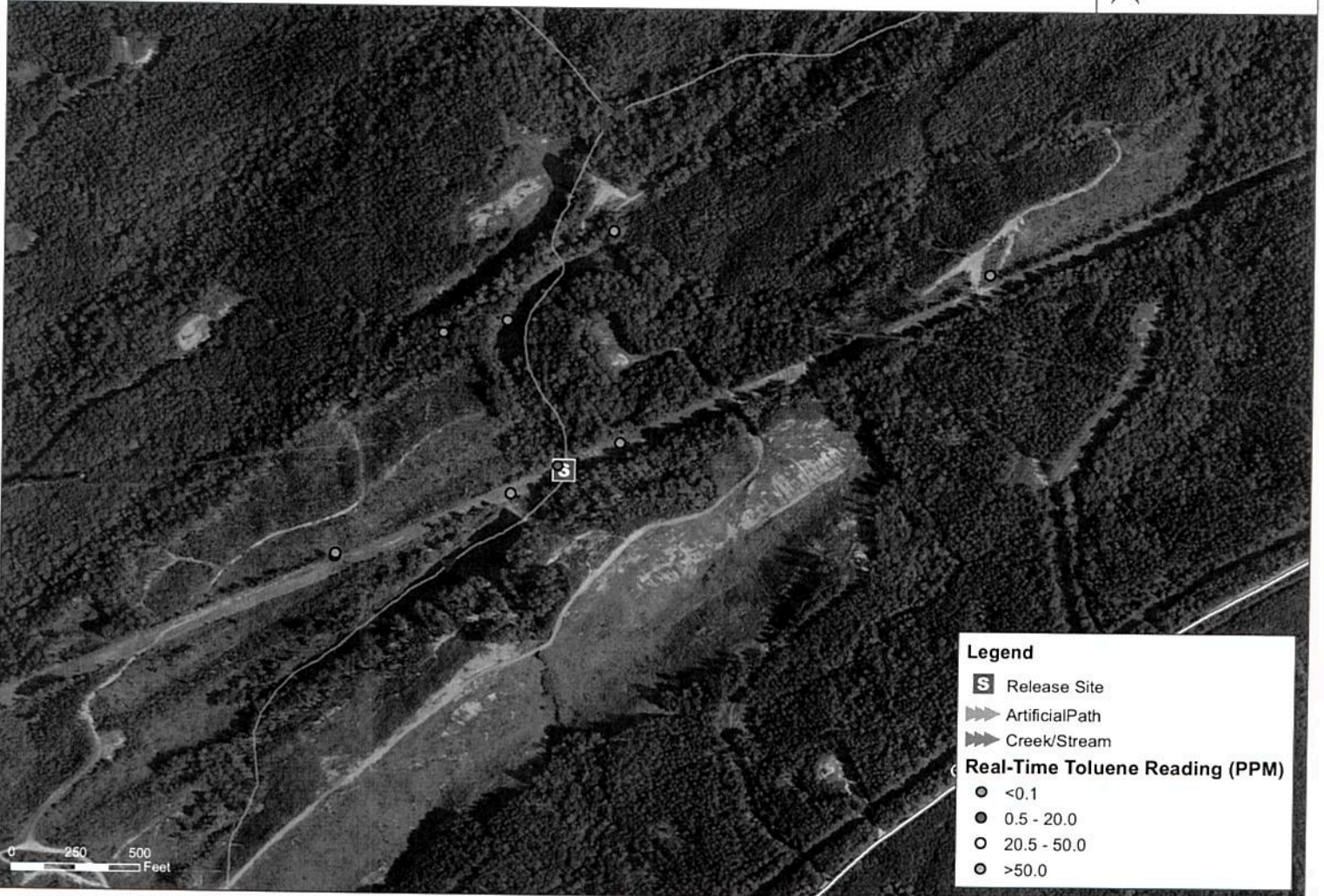


Manually-Logged Real-Time Readings | Toluene

CR-91 Event | 09/20/2016 05:00 – 09/21/2016 05:00



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, AL



PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

*GPS coordinates are approximate

Print Date: 9/21/2016



Manually-Logged Real-Time Readings | VOC

CR-91 Event | 09/19/2016 05:00 – 09/20/2016 05:00



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, AL



PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

*GPS coordinates are approximate

Print Date: 9/21/2016

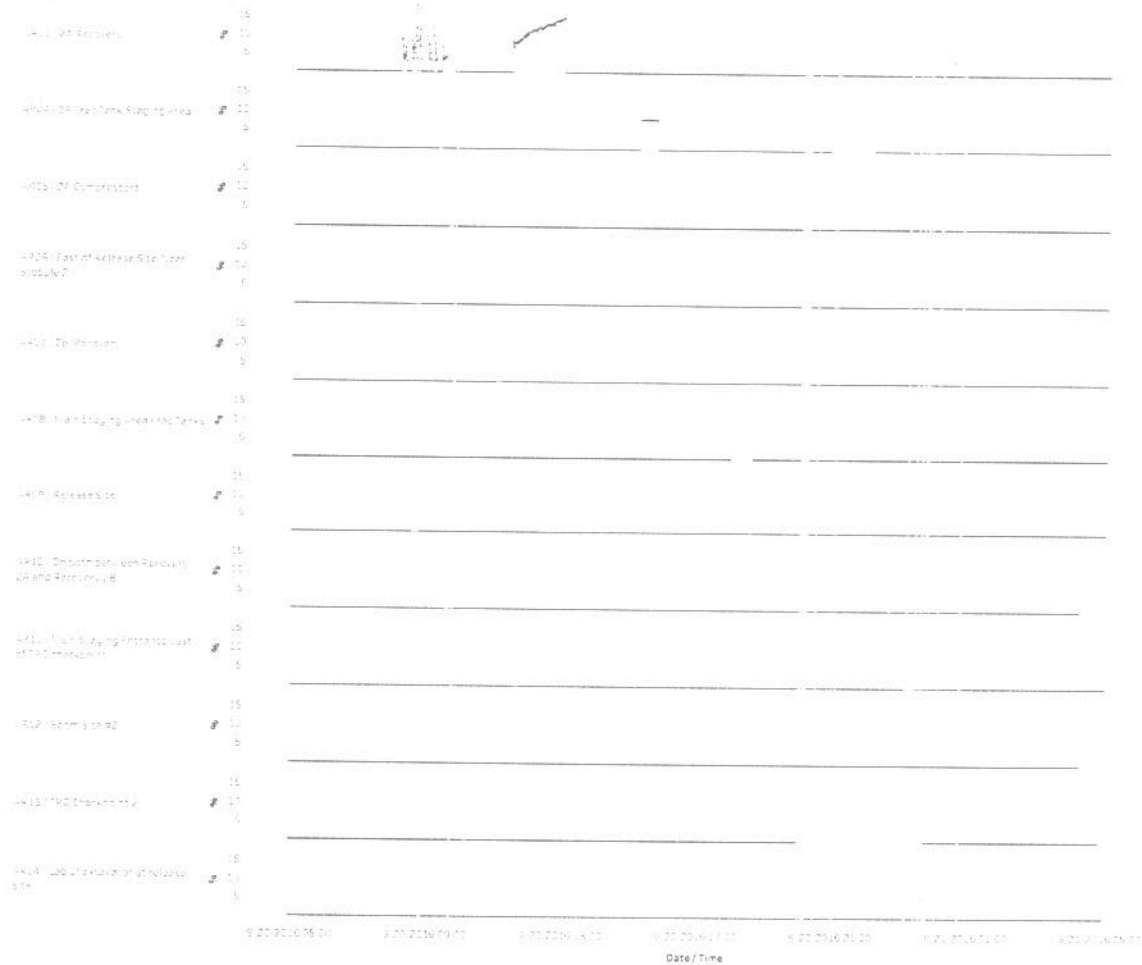
Appendix II:

Remote Telemetry Air Monitoring Graphs

Remote Telemetry Real-time Air Monitoring | LEL

CP-91 Event | 9/20/2016 05:00 to 9/21/2016 04:59

Unit/Location

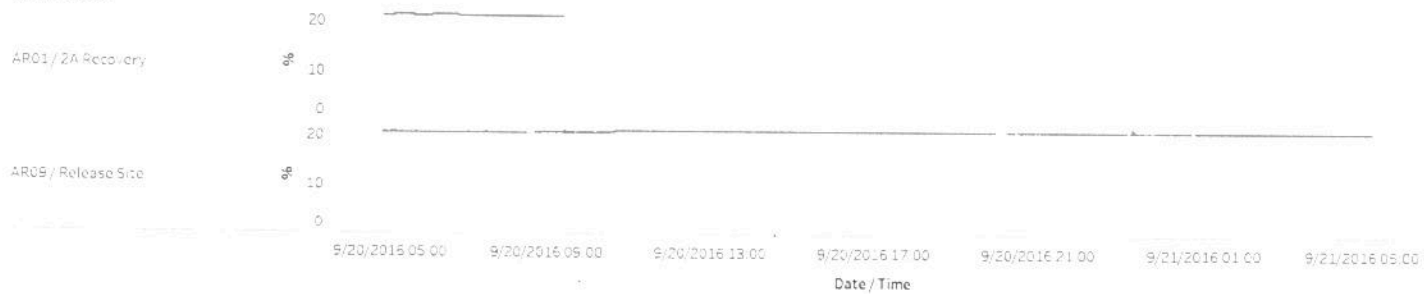


CP-91 Event | 9/20/2016 05:00 to 9/21/2016 04:59

Remote Telemetry Real-time Air Monitoring | Oxygen

CR-91 Event | 9/20/2016 05:00 to 9/21/2016 04:59

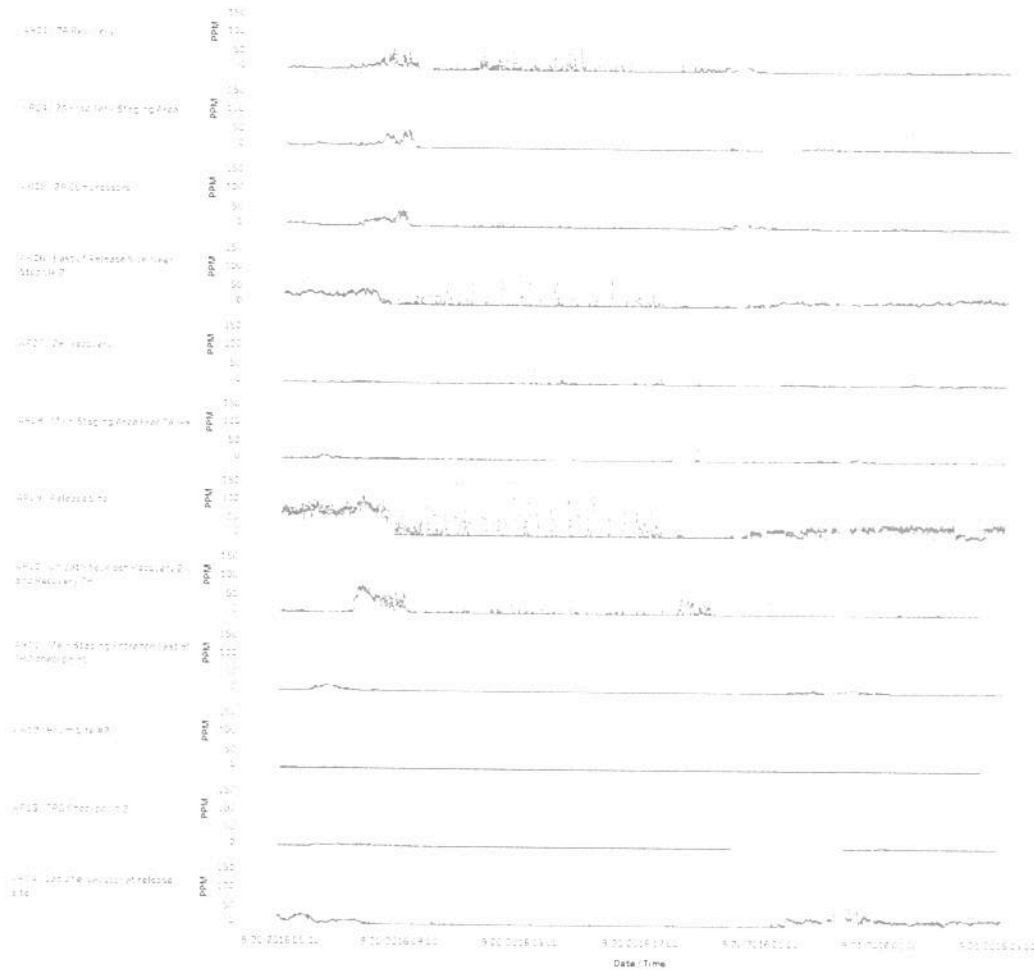
Unit / Location



Remote Telemetry Real-time Air Monitoring | VOC

CR-81 Event | 9/20/2016 09:00 to 9/21/2016 04:59

Unit / Location



CR21: CR22: CR23: CR24: CR25: CR26: CR27: CR28: CR29: CR30: CR31: CR32

CR-91 Event – Shelby County, AL
Preliminary Air Monitoring Summary
September 22, 2016 05:00

Prepared by
Center for Toxicology and Environmental Health, L.L.C. (CTEH®)
On Behalf of Colonial Pipeline



Introduction

On September 9, 2016, the Center for Toxicology and Environmental Health, L.L.C. (CTEH®) initiated air monitoring in support of response efforts to the gasoline release in Shelby County, AL. This report presents the real-time air monitoring data recorded from September 21 2016 05:00 to September 22, 2016 05:00 CDT.

Real-Time Air Monitoring¹

Real-time air monitoring was conducted to evaluate the potential airborne presence of gasoline-associated constituents, if any, during response operations. All instrumentation was calibrated at least once per day or per manufacturer's recommendations. Target analytes were measured as total volatile organic compounds (VOCs), oxygen, benzene, gasoline, hexane, naphthalene, xylene, and flammability as the percent of the lower explosive limit (LEL) using remote telemetering RAESystems® AreaRAEs, hand-held instruments such as RAESystems® MultiRAE Pro/Plus¹ and UltraRAEs, as well as Gastec® colorimetric detection tubes.

During this monitoring period, eight benzene, one LEL, and 12 VOC detections were recorded above the action level concentration during worker activity monitoring. During those instances when detections were sustained, workers were either wearing respiratory protection, or egressed the area in accordance with the approved sampling and analysis plan.

Table 1, below, presents the results of real-time air monitoring using hand-held instruments. Maps of the incident site location and locations of hand-held real-time air monitoring readings are provided in **Appendix I**.

¹ Real-time air monitoring refers to the use of hand-held instruments that provide near-instantaneous readings of an airborne chemical concentration without the need for laboratory analysis.

*Table 1: Hand-Held Real-Time Air Monitoring Summary¹
September 21, 2016 05:00 to September 22, 2016 05:00*

Location Category	Analyte	Instrument	Count of Readings	Count of Detections	Range of Detections ^{2,3}
Worker Activity Monitoring	Benzene	UltraRAE	155	33	0.05 - 4.9 ppm
	Gasoline	Gastec #101L	6	2	10 - 10 ppm
	Hexane	Gastec #102L	6	1	4 ppm
	%LEL	MultiRAE Plus	90	1	8 %
		MultiRAE Pro	253	0	<1 %
	Naphthalene	Gastec #60	1	0	<0.1 ppm
	Toluene	Gastec #122	3	2	5 - 5 ppm
		Gastec #122L	4	0	<0.5 ppm
	VOC	MultiRAE Plus	78	16	0.3 - 95 ppm
		MultiRAE Pro	281	130	0.1 - 500 ppm
Site Characterization	Xylene	Gastec #123	6	1	3 ppm
	Benzene	UltraRAE	1	1	1 ppm
	%LEL	MultiRAE Pro	5	0	<1 %
Community	VOCs	MultiRAE Pro	7	7	25.5 - 100.6 ppm
	%LEL	MultiRAE Plus	1	0	<1 %
	VOCs	MultiRAE Plus	1	0	<0.1 ppm

¹Please Note: The data displayed in the above table has not undergone complete QC analysis and is presented in a preliminary format.

²Maximum detections preceded by the "<" symbol are considered non-detections below the instrument limit of detection (LoD) value to the right.

³Numbers are the raw values, no correction factors have been applied.

In addition to worker activity monitoring, remote telemetering equipment established as an early warning system recorded no detections of VOCs above the site-specific action level of 300 ppm and 78 detections of LEL above the action level of 10% (3% as raw values on LEL sensors). **Table 2** (below) summarizes remote telemetering AreaRAE data for this monitoring period, which may contain drift events². **Appendix I** and **Appendix II** include location maps and graphs for remote telemetering data, respectively.

² Drift is defined as any interference in the PID's or electrochemical sensor's ability to accurately report the concentration of a chemical in the atmosphere. Humidity, rapid temperature changes, and compromised batteries are examples of common sources of drift.

*Table 2: Remote Telemetry Real-time Air Monitoring Summary^{1,3}
September 21, 2016 05:00 to September 22, 2016 05:00*

Unit	Location Description	Analyte	Count of Readings	Count of Detections	Range of Detections ²
AR01	2A Recovery	%LEL	4350	161	3 - 4.5 %
		VOC	4350	1638	0.1 - 129.2 ppm
AR04	2A Frac Tank Staging	%LEL	5334	0	<1 %
		VOC	5334	2202	0.1 - 14.7 ppm
AR05	2A Compressors	%LEL	5396	0	<1 %
		VOC	5396	915	0.1 - 30.4 ppm
AR06	East of Release Site/Near Stopple 2	%LEL	5446	0	<1 %
		VOC	5446	2185	0.1 - 158.4 ppm
AR07	2B Recovery	%LEL	5019	0	<1 %
		VOC	5019	3218	0.1 - 28.4 ppm
AR08	Main Staging Area Frac Tanks	%LEL	5449	0	<1 %
		VOC	5449	1319	0.1 - 15.2 ppm
AR09	Release Site	%LEL	5454	2	2.5 - 2.9 %
		O ₂	5454	5454	20.4 - 21.5 %
		VOC	5454	4224	0.1 - 283.6 ppm
AR10	On path between Recovery 2A and Recovery 2B.	%LEL	5257	0	<1 %
		VOC	5257	2948	0.1 - 100.8 ppm
AR11	Main Staging Entrance East of TRG checkpoint	%LEL	4278	0	<1 %
		VOC	4278	1772	0.1 - 9.5 ppm
AR12	Boom Site #2	%LEL	5559	0	<1 %
		VOC	5559	2147	0.1 - 1.9 ppm
AR13	TRG Checkpoint 2 - access to stopple 1, Recovery 2A and 2A Frac Tank Staging Area.	%LEL	5314	0	<1 %
		VOC	5314	1882	0.1 - 5.8 ppm
AR14	Cab of excavator at release site	%LEL	5287	0	<1 %
		VOC	5287	2433	0.1 - 34.4 ppm

¹Please note: The data displayed here has not undergone complete QA/QC analysis and is presented in a preliminary format.

²Maximum detections preceded by the "<" symbol are considered at the limit of detection (LoD) value to the right.

³LEL and VOC values are raw values, correction factors have not been applied.

Appendix I:

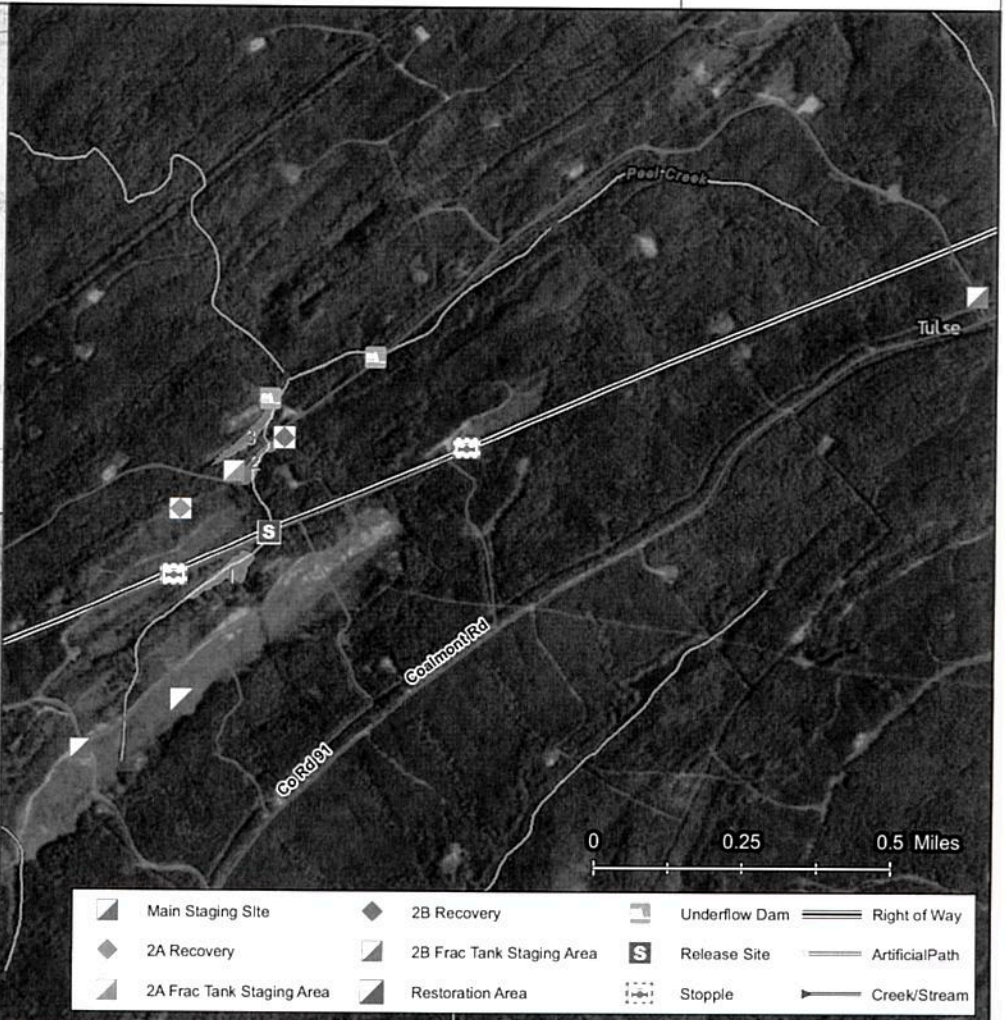
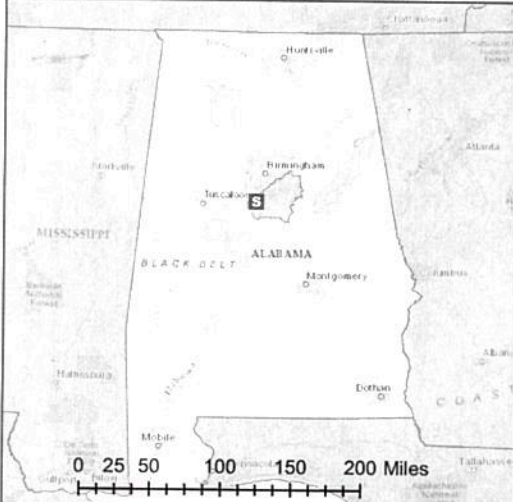
Site Location, Hand-Held Real-Time
Air Monitoring Location, and
Remote Telemetry Air Monitoring
Location Maps

CTEH

CR-91 Event
Site Location



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, AL



PROJECTION SYSTEM: UTM16 COORDINATE SYSTEM: WGS84

Print Date: 9/20/2016

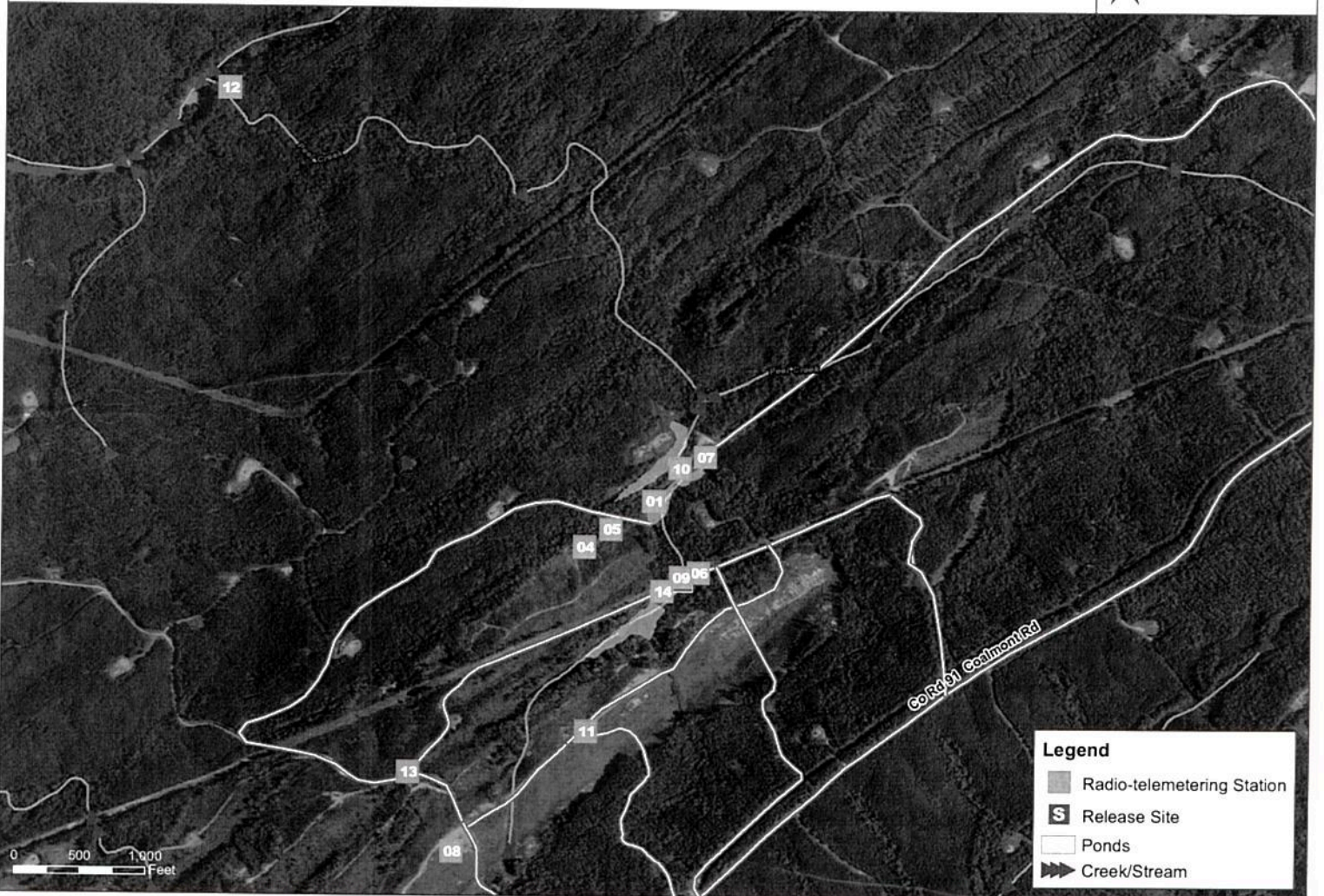


Radio-telemetry Real-time Air Monitoring Station Locations

CR-91 Event 9/22/2016



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, LA



PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

Print Date: 9/22/2016

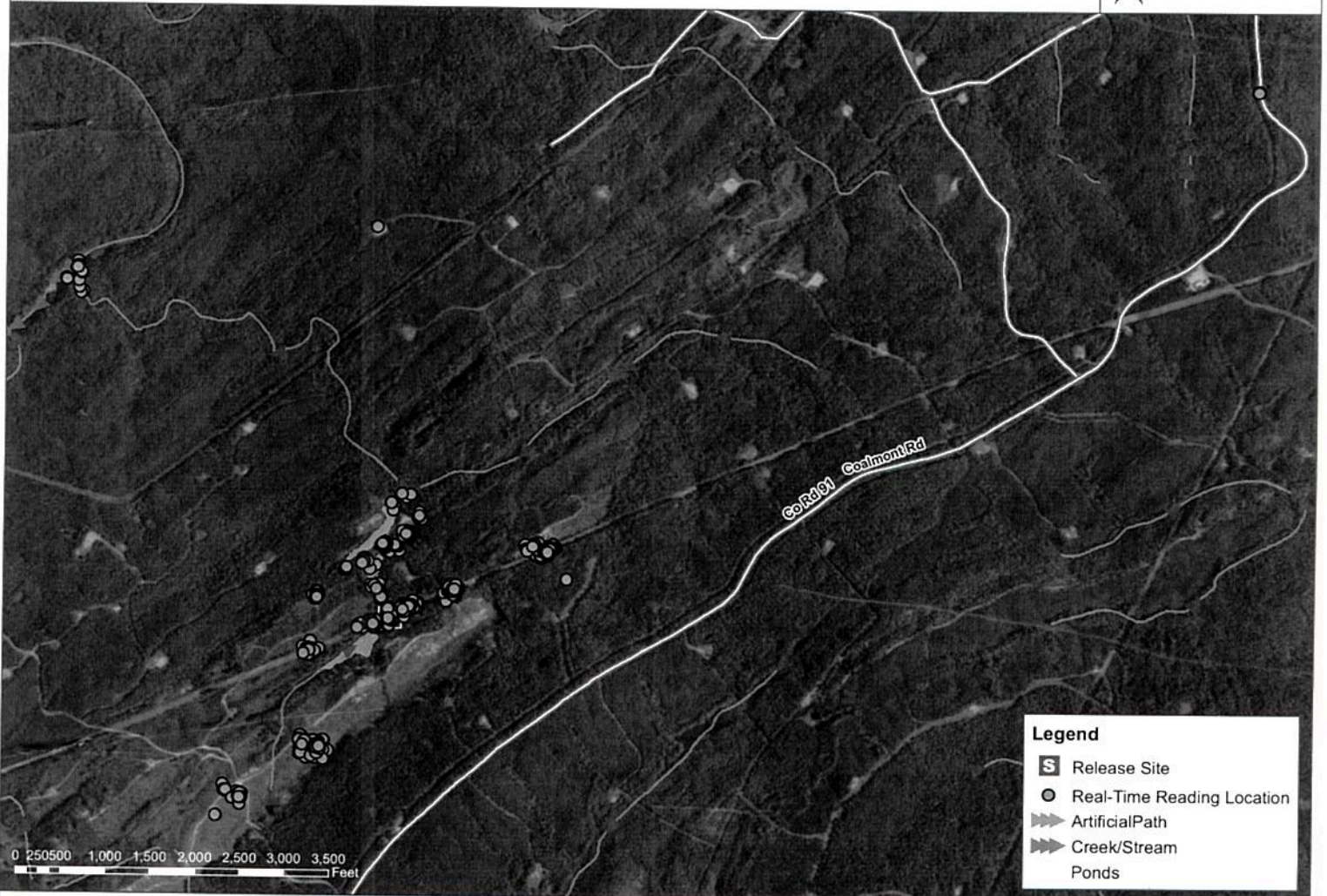


Manually-Logged Real-Time Reading Locations

CR-91 Event | 09/21/2016 05:00 – 09/22/2016 05:00



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, AL



PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

Print Date: 9/22/2016

*GPS coordinates are approximate

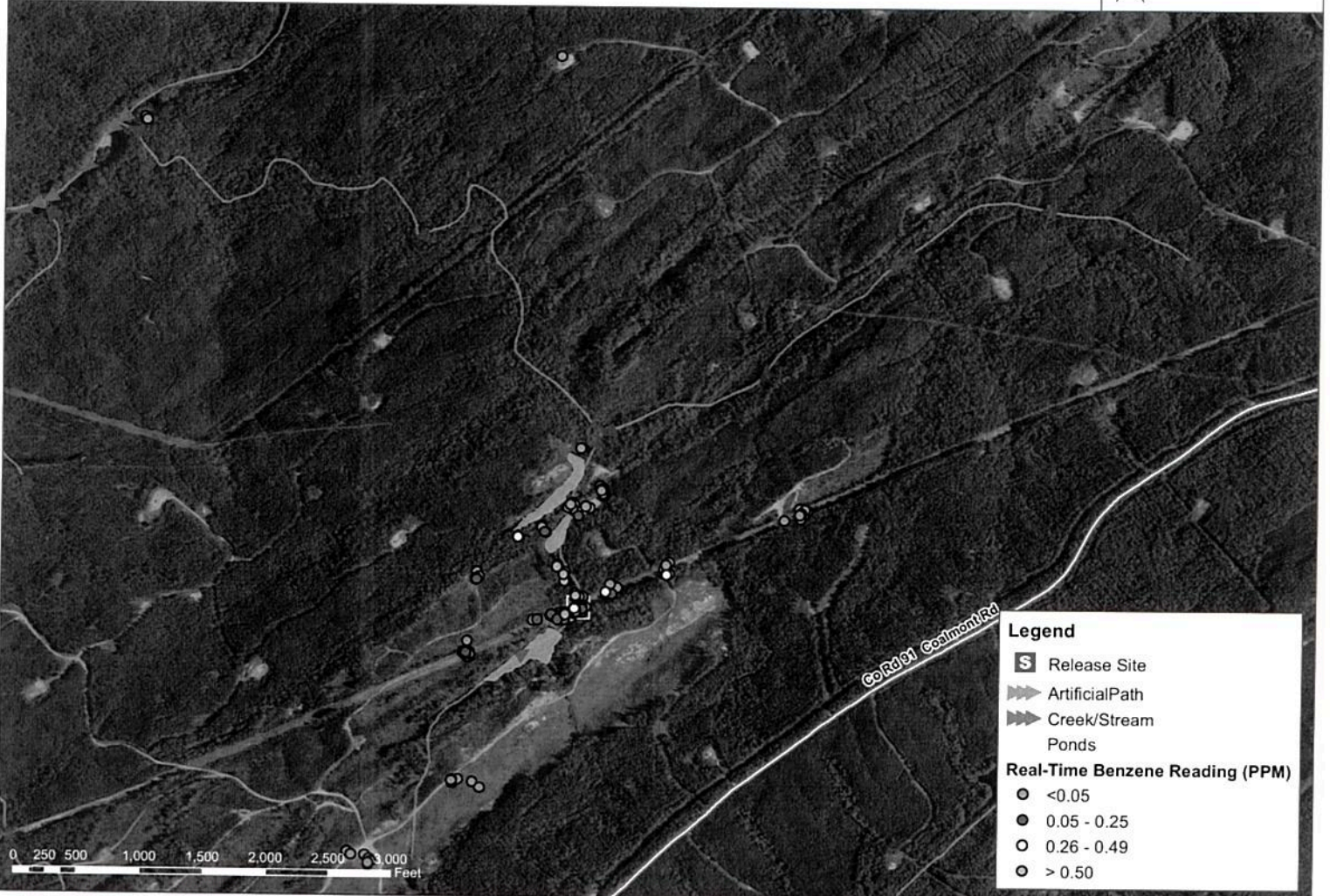


Manually-Logged Real-Time Readings | Benzene

CR-91 Event | 09/21/2016 05:00 – 09/22/2016 05:00



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, AL



PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

*GPS coordinates are approximate

Print Date: 9/22/2016

CTEH

Manually-Logged Real-Time Readings | Gasoline

CR-91 Event | 09/21/2016 05:00 – 09/22/2016 05:00



Project: 106465
Client: Colonial Pipeline
Location: Shelby County, AL



PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

*GPS coordinates are approximate

Print Date: 9/22/2016

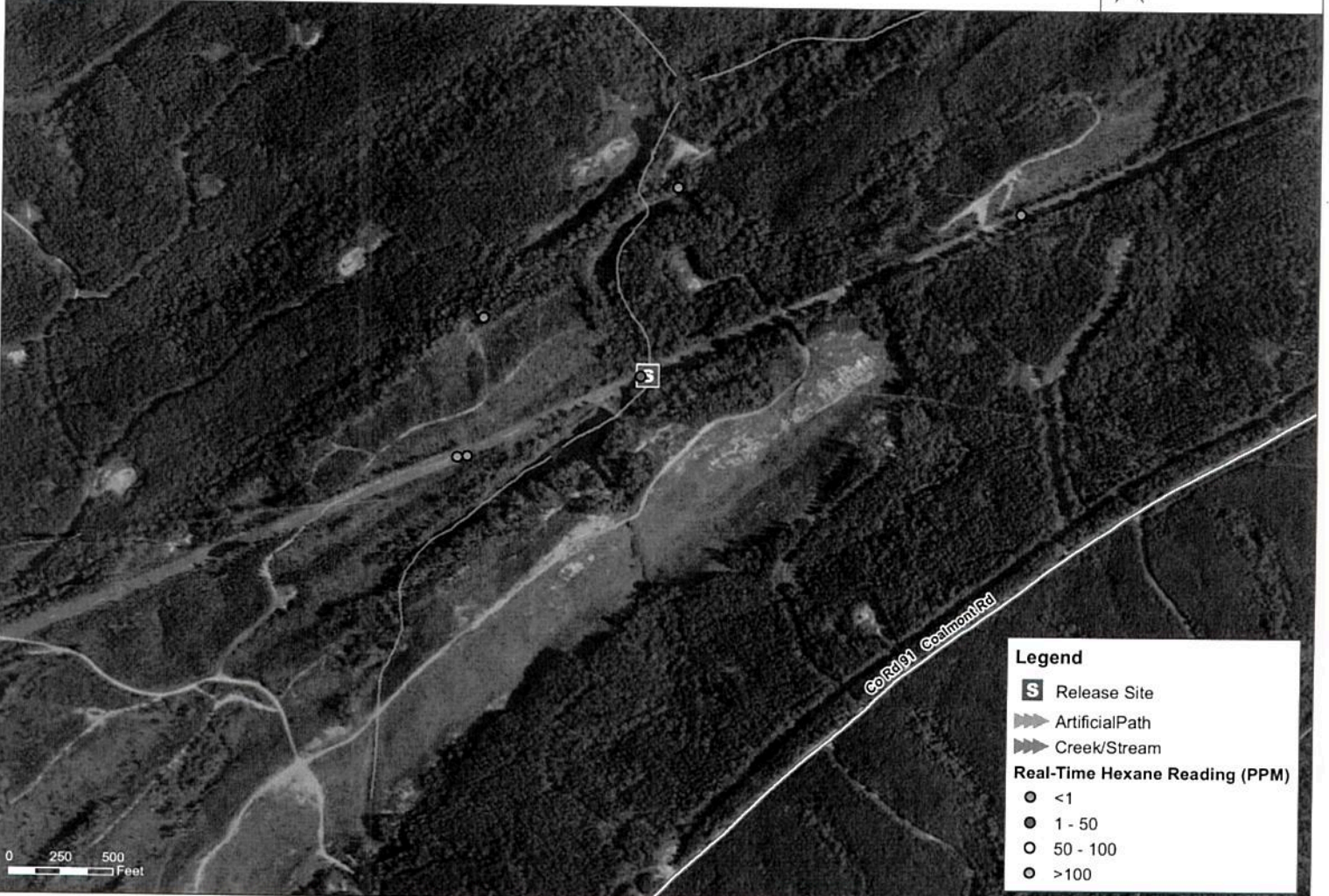


Manually-Logged Real-Time Readings | Hexane

CR-91 Event | 09/21/2016 05:00 – 09/22/2016 05:00



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, AL



Legend

Release Site

Artificial Path

Creek/Stream

Real-Time Hexane Reading (PPM)

<1

1 - 50

50 - 100

>100

PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

*GPS coordinates are approximate

Print Date: 9/22/2016

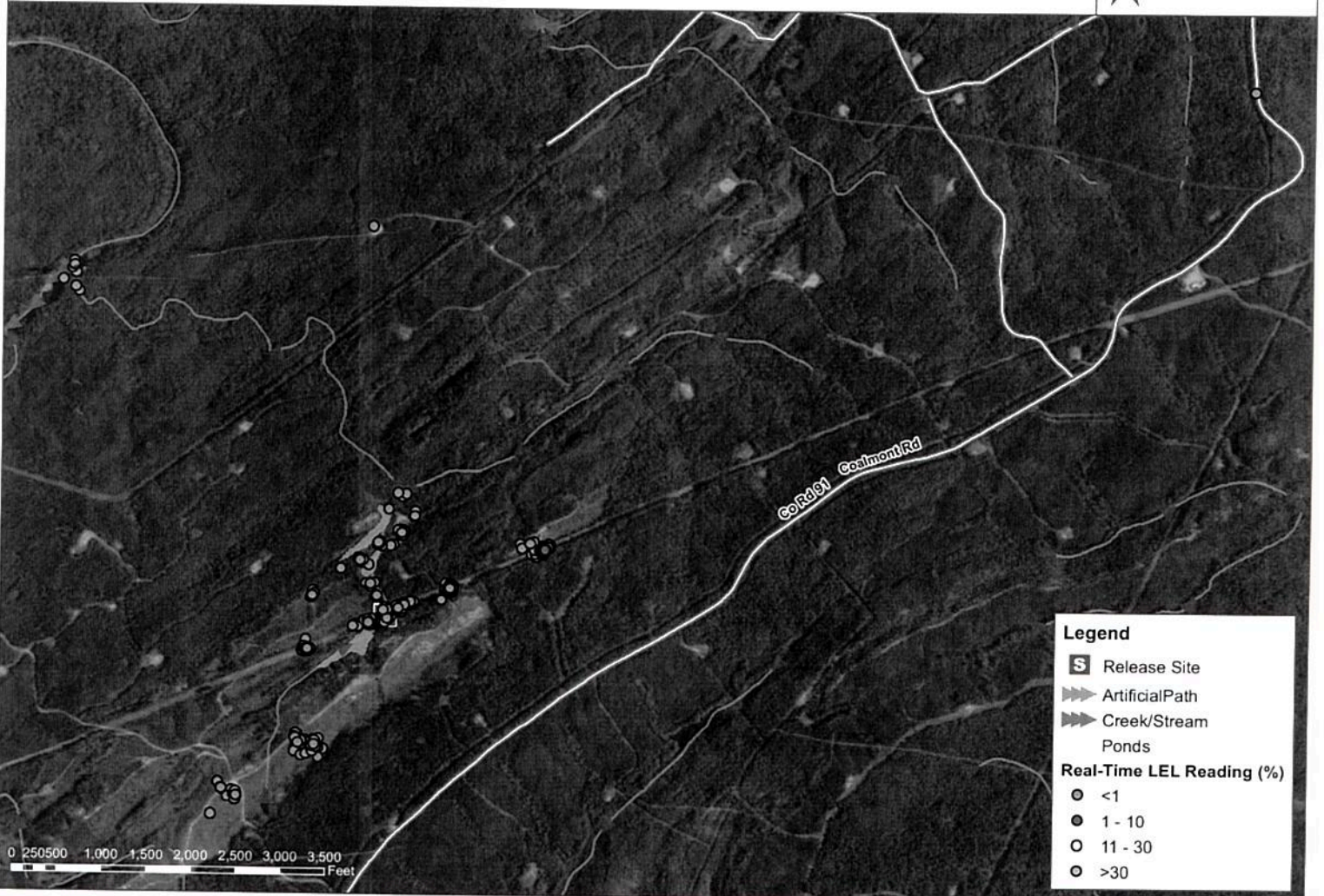


Manually-Logged Real-Time Readings | LEL

CR-91 Event | 09/21/2016 05:00 – 09/22/2016 05:00



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, AL



Legend

- Release Site
- Artificial Path
- Creek/Stream
- Ponds

Real-Time LEL Reading (%)

- <1
- 1 - 10
- 11 - 30
- >30

PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

*GPS coordinates are approximate

Print Date: 9/22/2016

CTEH

Manually-Logged Real-Time Readings | Toluene

CR-91 Event | 09/21/2016 05:00 – 09/22/2016 05:00



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, AL



Legend

S Release Site

➡ Artificial Path

➡ Creek/Stream

Real-Time Toluene Reading (PPM)

○ <0.5

● 0.5 - 20.0

○ 20.5 - 50.0

○ >50.0

PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

Print Date: 9/22/2016

*GPS coordinates are approximate

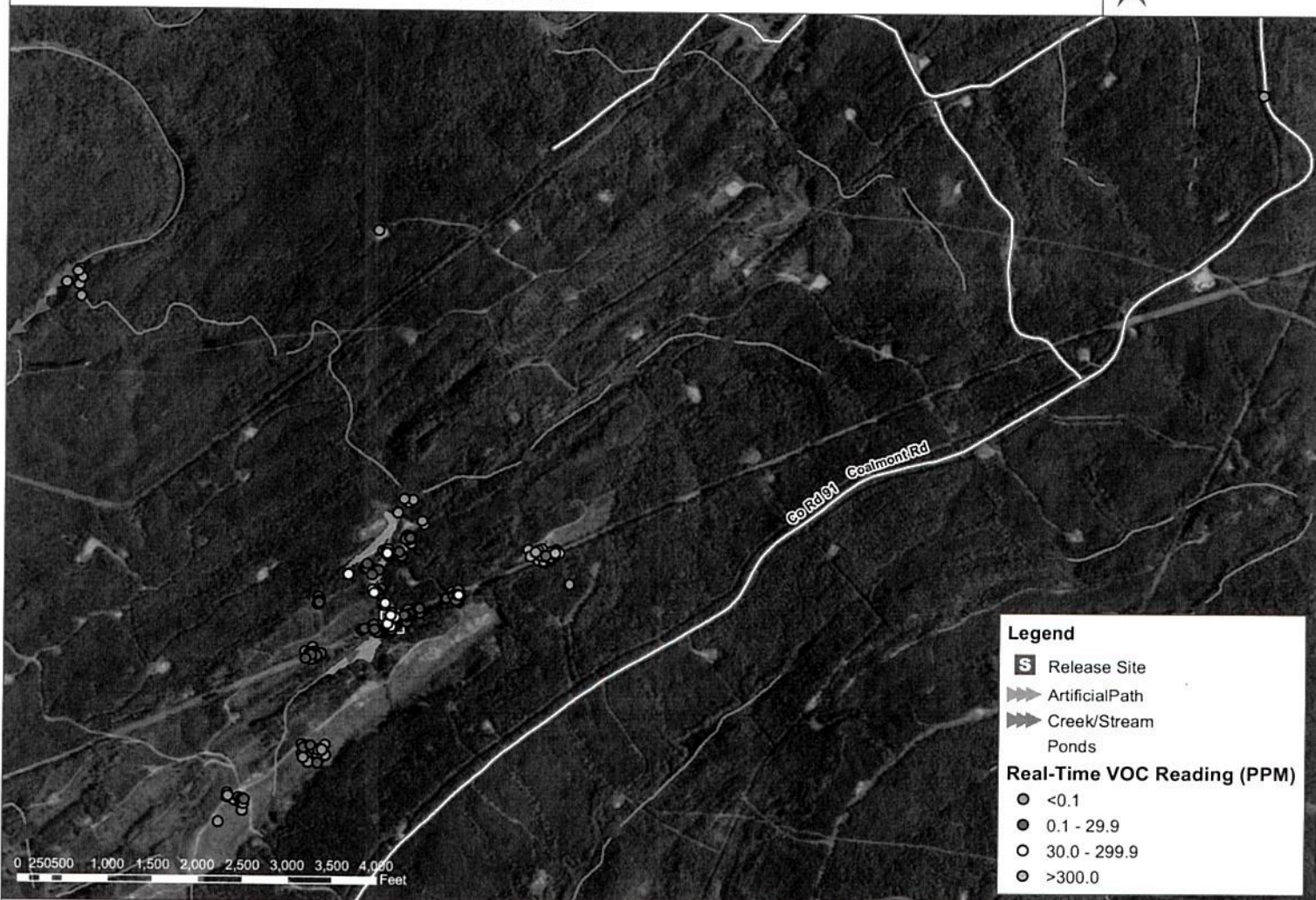


Manually-Logged Real-Time Readings | VOC

CR-91 Event | 09/21/2016 05:00 – 09/22/2016 05:00



Project: 108465
Client: Colonial Pipeline
Location: Shelby County, A...



PROJECTION SYSTEM: UTM Zone 16 COORDINATE SYSTEM: WGS84

Print Date: 9/22/2016

*GPS coordinates are approximate

Appendix II:

Remote Telemetry Air Monitoring Graphs

Remote Telemetry Real-time Air Monitoring | LEL

CP-91 Event | 9/21/2016 05:00 to 9/22/2016 04:59

Unit/Location



Current readings are a true representation of atmospheric conditions (appropriate correction factors have been applied) and are in % LEL.

Remote Telemetry Real-time Air Monitoring | Oxygen

CR-91 Event | 9/21/2016 05:00 to 9/22/2016 04:59

Unit / Location

AROS / Release Site

20
10
0

9/21/2016 05:00

9/21/2016 09:00

9/21/2016 13:00

9/21/2016 17:00

9/21/2016 21:00

9/22/2016 01:00

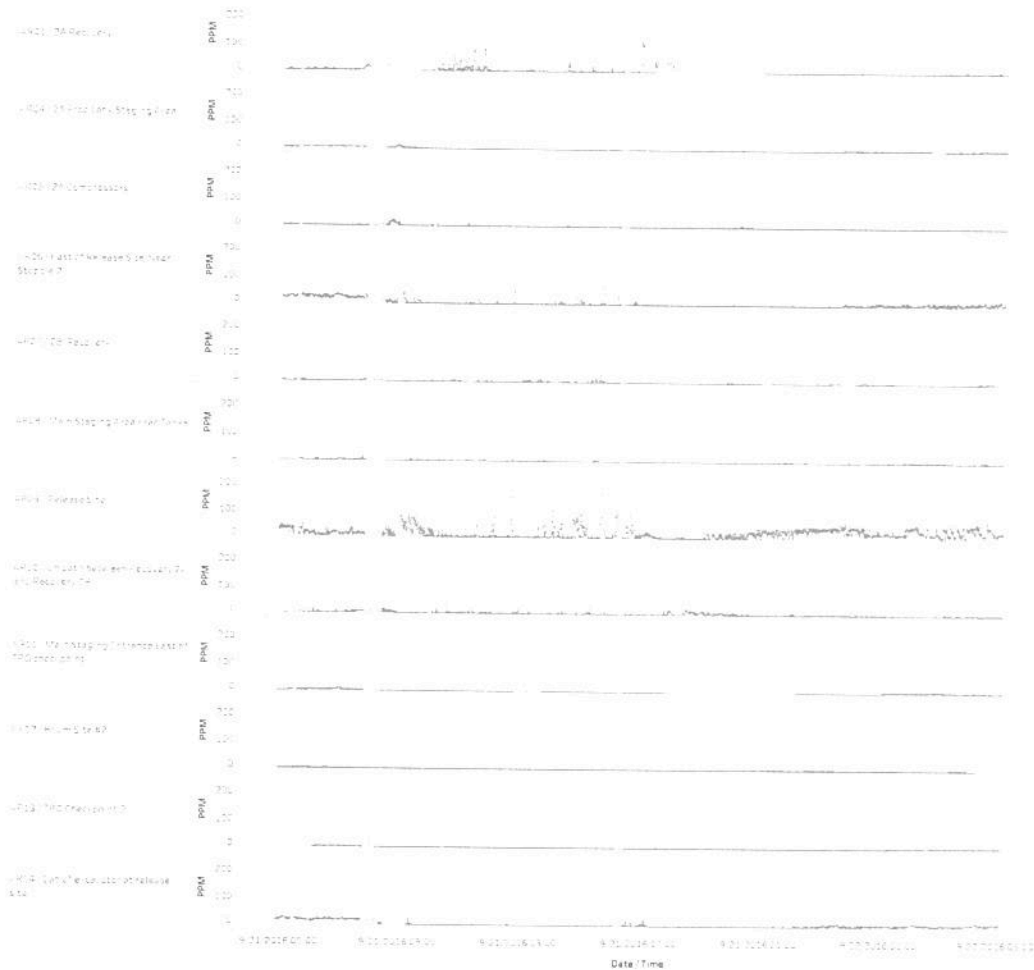
9/22/2016 05:00

Date / Time

Remote Telemetry Real-time Air Monitoring | VOC

On-92 Event | 9/22/2010 05:00 to 9/22/2010 04:59

Unit / Location



Notes: This is a real-time representation of the data. The data is not a perfect representation of the data. The data is not a perfect representation of the data.